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UNITED STATES DEPARTMENT OF AGRICULTURE
Washington, D. C

REPORT AND RECOMMENDATIONS
of the
GRAIN AND FORAGE CROPS RESEARCH ADVISORY COMMITTEE
Developed at its Meeting
February 15-19, 1965

Committee Membership:

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Additional copies of this report may be requested from W. C. Dachtler,
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PREFACE

The annual meeting of the Grain and Forage Crops Research Advisory Committee was held in Washington, D. C., February 15-19, 1965, with fourteen of the fifteen members present. The sessions on the first day were open to the public. During this period a number of representatives of agricultural and industry organizations, listed below, presented their views concerning research needs:

William Heckendorn, Executive Vice President, American Seed Trade Association

James P. Gaines, Executive Vice President, The Rice Millers' Association

Fred H. Mewhinney, Washington Representative, Millers' National Federation

Richard L. Kathe, Executive Vice President, American Dehydrators Association

Carroll Brunthaver, Director of Research, Grain and Feed Dealers National Association

William J. Hoover, Administrative Vice President, Corn Industries Research Foundation

Howard Morton, Director of Utilization Research, Great Plains Wheat, Inc.

As a basis for its recommendations and comments, the Committee made a systematic review of the Department's research programs for grain, rice, forage, feed and seed, as summarized in a Progress Report supplied to the Committee in advance of the meeting. The Progress Report material was supplemented by oral reports, visual materials, and discussion by program leaders and research administrators from the following USDA research divisions and agency units: Crops; Entomology; Agricultural Engineering; Nutrition and Consumer Use; Northern, Southern, and Western Utilization; Market Quality; Transportation and Facilities; Marketing Economics; Standards and Research; Economic and Statistical Analysis; and Farmer Cooperative Service.

Dr. N. C. Brady, Director of Science and Education, served as Chairman, and Dr. Fred R. Senti, Deputy Administrator, Agricultural Research Service, served as Vice Chairman during the meeting. The Executive Secretary was W. C. Dachtler, Research Coordinator, Research Program Development and Evaluation Staff.

After careful review of the information available, and based upon the current and future need for new knowledge, and the seriousness of problems faced by the industry, the Committee made the comments and recommendations included in this report to the Secretary of Agriculture.

COMMENTS AND RECOMMENDATIONS

GENERAL

Importance of Continued Agricultural Research

The Committee understands that a survey conducted by the F.A.O. of the United Nations indicated that one-third of the population of the earth is malnourished. It is estimated that the almost 3.3 billion people inhabiting the world today are increasing by geometric progression. This poses a very serious outlook for the availability of adequate food supply for coming generations. Population experts project the earth's population in the year 2020 to be around 8 billion people. We may well ponder the world's food problem in the year 2020 in view of the fact that presently one-third of the world's population suffers from malnutrition without hoping to improve the percentage of the earth's population already adequately nourished, great expansion in agricultural research is going to be necessary to hold our own.

It has been estimated that on any given day, considering the earth as a whole, there is only a 10 percent food supply--enough for 35 days consumption. We are very fortunate that this reserve is largely in the United States. Agricultural research made this situation possible and only with continuing adequate agricultural research will the situation be maintained.

In quantity, quality, and availability of food inhabitants of no other country eat better than do the American people. Our agriculture through its efficiency and know-how supplies the needs of our nation, provides adequate reserves and sends the production of 63 million acres out of 300 million acres harvested in trade to other nations. No other segment of the economy contributes more to a favorable balance of trade. This production has been accomplished by 7 percent of our people while 93 percent of our population is freed for employment in other occupations.

American farms are a priceless resource and heritage. Only adequate far-reaching effort and emphasis on expanded basic and applied research will continue to insure the ability of the American agriculture to contribute so much to the blessings of abundance, the welfare of the nation, and peace in the world.

Public Image of Agriculture

Every effort should be made to improve agriculture's image before public opinion. The fact of this should not be lost by the Department and its workers. As new developments that lead to better and more economical consumer products are achieved, an all-out release to the public of this information should be made. Agriculture's needs for support can best be served through a sympathetic and understanding public ear.

New Hybridization Techniques

The Committee feels that the new hybridization techniques recently developed in certain cereals should have a far-reaching effect, not only in improved varieties, but also in weed and disease control. The research scientists involved in this particular research throughout the nation are commended for their important contributions.

Importance of Developing New Uses for Agricultural Products

Creation of new markets for agricultural products can have significant benefits for the nation's economy and may contribute to a rising standard of living. Those research projects which offer an opportunity for developing new uses for a product should be given priority over those which may only serve to substitute one commodity for another without benefit to the consumer.

Automated Information Retrieval

With the growing complexities of interdisciplinary research, both within and between branches of the USDA, there is an urgent need to institute a simple automated cross reference retrieval system which identifies the (1) area of research, (2) objectives of the study, (3) primary project leader and (4) branch and location of the research effort. To be successful all research groups must cooperate and all new or proposed research efforts must check the retrieval center so that maximum coordination can be achieved.

Prompt Release of Research Information

Results and varietal improvements obtained from research studies should be made available to users as promptly as possible. In the plant breeding field the USDA scientists are urged to release their improved strains at the earliest opportunity in order that industry needs may be better met. This should be done when the work reaches the point where it can be of benefit to the industry even though the worker's ultimate goals have not been fully achieved.

Assistant Secretary for Science and Technology

Since science and technology are major factors in our national economy and since agricultural research is fundamental to our national well-being, the stature of this work should be emphasized by creating an Assistant Secretary for Science and Technology in the U.S. Department of Agriculture.

Improvement in Research Organization

The Committee commends the Director of Science and Education for his aggressive and logical new approaches to improve the research organization within the Department. Many, if not most, problems needing attention require the

application of multiple disciplines for adequate investigation and sound solutions. The steps being taken to more effectively coordinate the functioning of the USDA research program are highly commended by the Committee. It believes the establishment of the Research Program Development and Evaluation Staff in the Office of the Secretary, the package problem approach to budgeting, and the efforts to better coordinate the research work of the Department with that of the States and industry will do much to insure an efficient, effective, and sound program of agricultural research.

Establishment of Chemical Tolerance Levels

The Committee recommends that the Food and Drug Administration and the Department of Agriculture work closely together to set safe and workable chemical tolerance levels in food and feed products.

Use of P.L. 480 Funds for Research

The Committee is appreciative of the efforts being made to use for research funds made available from foreign operations under Public Law 480. It believes the application of an even greater amount of these funds is feasible and could profitably be applied to research in foreign areas where competent scientific personnel and adequate facilities exist.

FARM RESEARCH

Cultural, Breeding, Diseases, and Evaluation

The disease and insect picture can be expected to change continuously as crops are grown at high yield levels in the future, making a continuing breeding program essential. Average yield levels and efficiency of production from use of more precise irrigation, fertility, and cultural practices will advance progressively as a comprehensive breeding program continues.

Breeding programs will involve much greater detailed attention to disease reactions, insect resistance, and chemical composition as it influences quality and physiological responses to light, population density, and plant nutrients. In recognition of these significant changes it is vital that plans for future research programs reflect these changes and that work in progress be oriented and adapted to resolve problems and needs which the industry is facing.

The Committee wishes to recognize the change in emphasis and intensification of current resources toward utilizing hybrid vigor in plants. The team approach applied toward solving interdisciplinary problems involving agronomy, genetics, plant pathology, plant chemistry, and physics is necessary and should be continued wherever possible. A critical review of research in all commodities should be made in relation to their importance, and adjustments

made where indicated. Research scientists and administrators should work closely with industry in evaluating new varieties prior to their release.

Plant scientists are encouraged to work closely with animal scientists to find the ultimate value of all forages to animals. There is a need for grain and forage research to include an economic interpretation as a part of each research effort. Such coordination is essential for applied research to be more meaningful and useful to the industry. There is a need to intensify research on management in the production and utilization of grains and forages which will encourage an understanding of the factors related to the marketability of light-weight animals. The Committee is of the opinion that the research need is not a grazing management study of beef from grass but rather an understanding of the factors which facilitate the early marketing of light-weight beef. Forage grass and turf research appears to be inadequate. An imaginative approach is needed in both new and continuing research as relates to the basic problems in the industry.

The Committee again emphasizes the need for more information on control measures for diseases of grass, basic knowledge on physical-chemical properties of grass, and regional adaptability with special emphasis on developing range grasses which possess superior characteristics of drought resistance and salt tolerance.

The Committee believes emphasis should be given to the following:

Breeding and Disease Research

1. Winter cereals for grain-silage-pasture production.
2. Intensified research on the genetic interaction of resistance to cereal leaf beetle.
3. Stock rot and associated diseases and lodging in corn.
4. Intensified work on the corn virus disease complex.
5. Improving the feed and food value of oats.
6. Biochemical composition of alfalfa.
7. New methods for control of alfalfa weevil.
8. Studies of rice relating to: damage caused by smut; blast disease; hoja blanca resistant varieties; on physiologic discoloration; and fat content in bran of Belle Patna rice.

Cultural Practices

1. Additional research on seed crop culture, especially as it relates to standards for isolation requirements for seed fields and new procedures for seed analysis.
2. Research on seed characteristics of new materials such as hybrid sudans in relation to sorghum seed production.

Varietal Evaluation

1. Lesser legumes should be studied to find varieties adapted to western rangeland, in addition to other areas, which are palatable, productive and long-lived. The Committee concurs in the change in emphasis in the South to study adapted legumes for pasture management.

2. Plant growth requirements in relation to natural and controlled environments.

Weed Control

The Committee feels that the approach to weed research must be more definitive and recommends that it be directed toward basic research with particular emphasis on the life cycle of weeds. With this in mind it would like to see research presently in effect, or to be initiated, directed toward destroying weeds at the most vulnerable point in their life cycles.

Attention also should be channeled toward these specific weed problems:

(1) dodder in legume seed crops; (2) wild oats in dry farmed cereals; (3) annual grasses in corn, rice and soybeans; (4) Johnson grass (5) woody plants on rangelands; and (6) deep seeded broadleaf annuals **and perennials**

Studies should be continued on herbicide residues with specific attempts to determine effect on subsequent crops.

Studies should also be initiated to explore the genetic relationship of susceptibility of plants to chemicals.

Nematode Control

Research efforts on nematodes should primarily be directed toward studies of their basic nature.

Insect Control

It is paramount that we maintain a control over harmful agricultural insects. Because insect losses are astronomical, all types of control measures must be used. Emphasis on long term insect control should be directed toward biological control, plant resistance and development of predator and parasitic populations. It is recognized that such controls may not be quickly initiated and in the interim we must rely on chemicals.

It is proposed that the mechanics of a containment program for harmful insects be developed. Such programs should be aimed at total destruction with the initial appearance of any new and harmful insects.

Specific research activity should be accelerated to control the following:
(1) alfalfa weevil, (2) cereal leaf beetle, (3) western corn root worm,
(4) insect vectors of corn stunt and maize dwarf mosaic, and (5) rice water weevil.

It is recommended that the use of P.L. 480 funds be expanded to explore resistant plant material, biological control, and specific predators in areas where the insect has been known for many years.

Agricultural Engineering

Agricultural Engineering research must be related to the broad spectrum of crop production, processing, and utilization. Altering any cultural practice or production procedure in the chain from seed bed preparation to ultimate crop use will usually result in changed relations with regard to quality, quantity or cost of product. Therefore, it is suggested that a "systems approach" to most agricultural engineering problems be initiated. This approach should be applied to present problems in the following areas: (1) corn production, harvesting and storage; (2) forage handling, processing, and feeding; (3) application by aircraft of dry materials in crop production; (4) small seed production, harvesting, and processing.

Within the framework of a "systems approach" particular emphasis should be directed toward basic engineering studies in the harvesting, drying, processing, and pelletizing of the various forages and grains.

Continued research toward developing mechanical, electrical, or radiation devices to control or eradicate harmful insects should be encouraged.

NUTRITION, CONSUMER, AND INDUSTRIAL USE RESEARCH

Human Nutrition

The Committee is pleased with the progress being made in the area of human nutrition and with the plans for further programs intended to extend knowledge of the nutritional values of cereal grain products. Of special significance may be the preliminary observations showing a relationship between carbohydrate source, nutritional well-being, and lipid metabolism. We urge prompt and vigorous follow up to establish more clearly the significance that carbohydrate type may have in human nutrition.

Two projects, one at Michigan State University, the other in Hong Kong, have demonstrated the adequacy of human diets with higher than usual levels of cereal protein. It is hoped that these studies will be extended to provide further data on this subject.

Multinutrient analyses of wheat and wheat products, soon to start, will provide information desired by nutritionists and requested by the industry. The Committee recommends immediate extension of this project to include other cereals and cereal products used as human food.

Food Consumption

Because consumption of foods is largely dependent upon their palatability, it is important to gain a better understanding of why people exhibit varying taste preferences so this information may be used in the formulation of foods having good consumer acceptance. Because of their declining popularity with consumers, cereal products are especially in need of attention. We urge consideration of a project along such lines.

The Committee feels that the 1965 Food Consumption Survey will provide much needed information and recommends that the data obtained be promptly evaluated and disseminated. Special surveys may be required to determine the nutritional status of selected groups as indicated by food consumption patterns.

Industrial Uses for Cereals

Development of industrial uses for cereal grains and for byproducts of their processing is essential to maintain the well-being of those sectors of the economy concerned with the production and processing of these commodities. Because funds, personnel, and facilities for this work are limited, great care must be taken in selection of projects to be carried out. Once underway, a project in utilization research deserves periodic, critical, and objective review to determine when it should be terminated for one of the following reasons:

1. Basic information indicating technical and economic feasibility has been acquired. Project is ready for industrial exploitation.
2. Technological opportunity is not what it had appeared to be when project was initiated.
3. Economic or market evaluation, including the opinions of potential processors or consumers, indicates remote possibility of commercial success.

A real hazard in this activity is that of carrying projects too far because of investigator faith and enthusiasm. This may have the effect of greatly limiting the number of opportunities that can be exploited.

The Committee favors continuation of the cooperative work with plant breeders and commercial processors on the development of high amylose lines of corn and research on the determination of chemical and physical properties of the starch products.

Food and Feed Uses

The Committee commends the researchers engaged in utilization research for their achievements and dedication to their work. We feel it is especially important that those working in this activity be aware of what others are doing and remain alert to the possibility of adopting new approaches. For example, heat treatment to accelerate aging of rice suggests a possible approach to accomplishing the maturing of wheat or flour and the air-steam treatment to sterilize forage seeds may be extended to control microbial contamination in grain to be processed into food products.

The Committee strongly opposes plans announced by USDA to eliminate rice utilization research at the Southern and Western Regional Laboratories in view of the fact of its economic significance in the United States (a 315 million dollar crop) and the potential for further economic development through utilization research. Research and development are needed on the following: (1) production of high protein rice flour by recently discovered deep-milling techniques; (2) basic studies on the chemical, biological, and physical properties, both raw and cooked, coordinating the work carefully between laboratories to prevent duplication of effort. Completion and publication of the literature compilation on known facts about the chemical and physical properties of rice should be expedited.

The Committee urges that research be conducted to upgrade the various constituents of mill feeds for human consumption. This upgrading should also help in providing better and more uniform products for formula feeds.

The Committee also recommends the continuation of studies to determine the level of nutrient components of forage and grain crops in the various market grades. The results of this work will become a useful working tool for the user in feed formulation. This is becoming increasingly important in the use of computers to determine least of cost feeding.

As the level of nutrient components becomes known, biological studies should be instituted to determine their degree of availability. Again, this information will enhance the utility of the forage or grain in the formulation of the feed ration.

The Committee recommends that work be expanded with dehydrated alfalfa in the identification of unidentified factors for growth, health, and reproduction. Further evaluation of coumestrol for its beneficial or detrimental characteristics should proceed. Also, continued investigation of the important pigmentation factors should be carried on.

It appears that product improvement can be accomplished through mechanical fractionating of dehydrated alfalfa. The work thus far has resulted in a high nutrient quality fraction with low fiber content. The remaining fraction

containing high fiber should be explored for feed and chemurgic uses. Studies should be made of methods of treating the cellulose-lignin components in order to enhance their digestability. The distribution of the amino acids, vitamin, mineral, and pigmentation components to the various fractions should be determined.

MARKETING AND ECONOMIC RESEARCH

In general the Committee is of the opinion that the plans being pursued by the Department with regard to problems relating to the marketing of grain and forage crops and related products are good. Its recommendations primarily have to do with emphasis upon present research rather than the exploration of entirely new fields of research.

Sampling and Testing Methods and Equipment

The Committee recommends the continued study of improved commercial sampling and testing methods and equipment for use on hay, grains, seeds, and feed products that minimize human error. Particular emphasis should be given to adequate sampling of large quantities of grain being handled by fast moving machinery.

Seed Quality during Storage

Additional research is needed to determine the inherent characteristics and environmental characteristics that cause some seeds to retain their viability and vigor better than others. Also, research is needed to determine the chemical, physiological, and biochemical changes which occur during storage.

Handling, Aerating and Drying Grain and Forages

There is a never-ending need for research on methods and equipment for handling grain, seed, forage crops, and feeds to minimize waste and damage, and at the same time facilitating efficient movement.

We recommend continuation of the engineering work being done on grain aeration and the drying of corn and grain sorghum.

Research for the maintenance of quality and the efficiency of movement by means of the pelleting and wafering process of forage crops should be continued.

Insect Control

The Committee recommends the continuing study of methods of insect control other than through the use of chemicals which may leave residues harmful to men or animals. This includes exploration in the use of such non-chemicals as isotope irradiation, sound and radio frequencies, and inert dusts. We recommend the development of rapid simplified detection methods which would provide accurate measurements of pesticide residues and hidden infestation.

The use of P.L. 480 funds in the study of the Khapra beetle should be continued and similar studies should be extended to the Senn bug and any other dangerous insect that might gain entry to the United States to become a grain storage pest

Information on Quality Factors

A continuation of the search for additional basic information on protein structure and properties of wheat, rice, corn, and soybeans is recommended. We feel that increased attention should be given to the identification of the compounds responsible for some of the natural variations in quality. We also recommend the continuation of the work on microbiology of wheat and flour.

Foreign Market Problems

Current and accurate information is needed regarding the grade and condition of exported grains, grain products, and forage products upon arrival at destination. The Committee recommends that a way be developed to obtain such information on a continuing basis so that comparison with origin grades may be readily made.

In countries deficient in the production of wheat, studies should be made with regard to the possibility of educating them concerning the best uses of our wheat. At the same time, research should continue to develop acceptable new maturing treatments for flours and to improve the market quality of U.S. wheats for foreign acceptance.

Another aspect of the export market needing increased research attention is the determination of the kinds of new wheat products suitable for the vast regions of the world where wheat is not yet a major food source.

Continuing economic research should be conducted in all international aspects of trading in grain and forage products. The disadvantages of U.S. industries in trading with foreign governments, trading combines, such as the Common Market, and cartels should be studied.

We also suggest that the possibility be investigated for the use of P.L. 480 funds to make studies that might lead to long-term dollar markets for U.S. grains and forages.

Transportation of Grains and Forages

Transportation research is needed which will (1) identify those forces encouraging changes in railroad rate structures; (2) estimate the extent these forces will continue to encourage revision; and (3) make a judgment, insofar as possible as to the impact upon the grain, feed, and milling industries that must follow the unregulated rate quotations of the common carriers and the

various rates quoted by individual railroads for unit train movements, multi-car shipments, and the use of shipper owned cars

Market Potential for Cereal Products

We urge continued efforts to determine existing possibilities and additional opportunities for using cereal products for industrial purposes.

Consumer Preferences

We are pleased that a study is being activated that would measure consumer attitudes and preferences concerning the various cereals and other products, and the reasons for consumers' changing purchasing habits.

Cooperative Marketing

The Committee looks with favor upon the good work done in the past by the Farmer Cooperative Service in the field of marketing and economic research and its continuance is advocated.

Statistical Data

Continuing efforts should be made, through research, to improve the accuracy of crop production and inventory stock estimates. More emphasis should be placed on the gathering, analyzing, and publishing of pertinent statistics on the world supply and demand for our principal grain, forage, and seed crops and their end products.

